



ComEd Weatherization Rebates Impact Evaluation Report

Energy Efficiency / Demand Response Plan:
Program Year 2018 (CY2018)
(01/01/2018-12/31/2018)

Presented to
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DRAFT

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1. INTRODUCTION

This report presents the results of the impact evaluation of ComEd’s CY2018 Weatherization Rebates (Wx) Program. It presents a summary of the energy and demand impacts for the total program and broken out by relevant measure and program structure details. The appendix presents the impact analysis methodology. CY2018 covers January 1, 2018 through December 31, 2018.

2. PROGRAM DESCRIPTION

The Wx Program offers incentives for the installation of qualifying weatherization improvements such as attic and wall insulation, and air and duct sealing. The weatherization rebates are instant rebates that are applied to the customer invoice by a participating contractor.

A notable program change made from PY9 to CY2018 includes combining the implementation of the program from two implementation contractors into one to ensure program consistency across the ComEd service territory. In the previous cycle, CLEAResult implemented the program in the portion of ComEd service territory that is served by Nicor Gas, and Franklin Energy implemented the program in the portion served by Peoples Gas and North Shore Gas. In CY2018, Franklin Energy implements the program throughout the ComEd service territory. The program continues to be jointly delivered with the gas utilities.

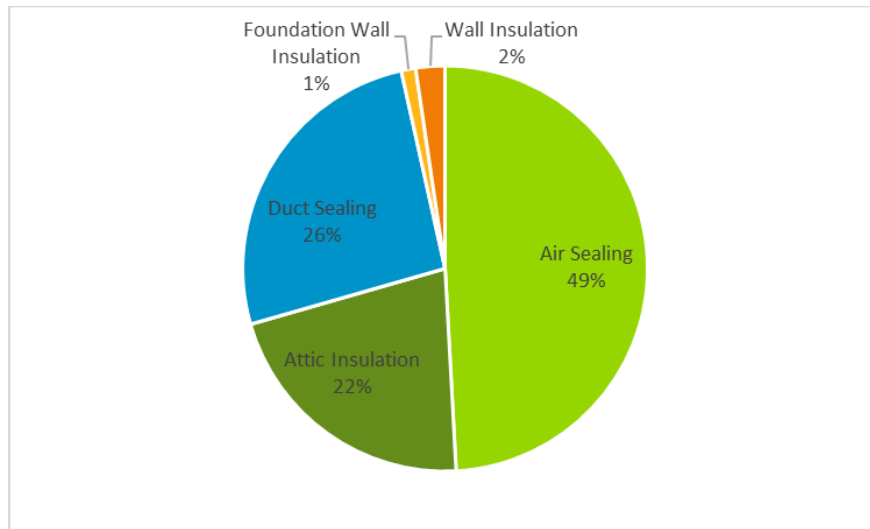
The program had 1,807 participants in CY2018 and distributed 3,643 measures as shown in the following table and graph.

Table 2-1. CY2018 Volumetric Findings Detail

Participation	Rebate
Participants	1,807
Total Measures	5
Measures Installed	3,643
Total Projects	1,811

Source: ComEd tracking data and Navigant team analysis.

Figure 2-1. Percent of Measures Installed by Type



Source: ComEd tracking data and Navigant team analysis.

3. CUMULATIVE PERSISTING ANNUAL SAVINGS

The measure-specific and total verified gross savings for the Wx Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2018 are shown in the following tables and figure. The total CPAS across all measures is 796,737 kWh. The program achieved 1,388,074 kWh CPAS equivalent of gas savings converted to electricity that might be counted toward ComEd’s goal¹ (the middle table in the following set of tables). Adding the savings converted from gas savings to the electric savings produces a total of 2,184,811 kWh of total CPAS.

¹ The evaluation will determine which gas savings will be counted toward goal while producing the portfolio-wide Summary Report.

Table 3-1. Cumulative Persisting Annual Savings (CPAS) – Electric

End Use Type	Research Category	EUL	CY2018 Verified Gross Savings	NTG*	Lifetime Net Savings†	Verified Net kWh Savings									
						2018	2019	2020	2021	2022	2023	2024	2025	2026	
Shell	Air Sealing**	15.0	411,664	1.01	6,236,709	415,781	415,781	415,781	415,781	415,781	415,781	415,781	415,781	415,781	
Shell	Attic Insulation**	25.0	81,925	1.01	2,068,605	82,744	82,744	82,744	82,744	82,744	82,744	82,744	82,744	82,744	
Shell	Duct Sealing	20.0	267,311	1.01	5,399,678	269,984	269,984	269,984	269,984	269,984	269,984	269,984	269,984	269,984	
Shell	Basement / Sidewall Insulation*	25.0	16,009	1.01	404,222	16,169	16,169	16,169	16,169	16,169	16,169	16,169	16,169	16,169	
Shell	Wall Insulation**	25.0	11,940	1.01	301,478	12,059	12,059	12,059	12,059	12,059	12,059	12,059	12,059	12,059	
CY2018 Program Total Electric CPAS			788,848		14,410,692	796,737	796,737	796,737	796,737	796,737	796,737	796,737	796,737	796,737	
CY2018 Program Expiring Electric Savings‡															

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Shell	Air Sealing**	415,781	415,781	415,781	415,781	415,781	415,781						
Shell	Attic Insulation**	82,744	82,744	82,744	82,744	82,744	82,744	82,744	82,744	82,744	82,744	82,744	82,744
Shell	Duct Sealing	269,984	269,984	269,984	269,984	269,984	269,984	269,984	269,984	269,984	269,984	269,984	269,984
Shell	Basement / Sidewall Insulation*	16,169	16,169	16,169	16,169	16,169	16,169	16,169	16,169	16,169	16,169	16,169	16,169
Shell	Wall Insulation**	12,059	12,059	12,059	12,059	12,059	12,059	12,059	12,059	12,059	12,059	12,059	12,059
CY2018 Program Total Electric CPAS		796,737	796,737	796,737	796,737	796,737	796,737	380,956	380,956	380,956	380,956	380,956	110,972
CY2018 Program Expiring Electric Savings‡		-	-	-	-	-	-	415,781	415,781	415,781	415,781	415,781	685,765

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Shell	Air Sealing**												
Shell	Attic Insulation**	82,744	82,744	82,744	82,744								
Shell	Duct Sealing												
Shell	Basement / Sidewall Insulation*	16,169	16,169	16,169	16,169								
Shell	Wall Insulation**	12,059	12,059	12,059	12,059								
CY2018 Program Total Electric CPAS		110,972	110,972	110,972	110,972	-	-	-	-	-	-	-	-
CY2018 Program Expiring Electric Savings‡		685,765	685,765	685,765	685,765	796,737	796,737	796,737	796,737	796,737	796,737	796,737	796,737

Note: The green highlighted cell shows program total first year electric savings.

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

**These measures may include gas savings that are potentially claimed by Nicor Gas, Peoples Gas or North Shore Gas, in their respective territories.

† Lifetime savings are the sum of CPAS savings through the EUL.

‡ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.

Source: Navigant analysis

Table 3-2. Cumulative Persisting Annual Savings (CPAS) – Gas

End Use Type	Research Category	EUL	CY2018 Verified Gross Savings (Therms)	NTG*	Lifetime Net Savings†	Verified Net Therms Savings										
						2018	2019	2020	2021	2022	2023	2024	2025	2026		
Shell	Air Sealing**	15.0	16,208	1.01	245,549	16,370	16,370	16,370	16,370	16,370	16,370	16,370	16,370	16,370		
Shell	Attic Insulation**	25.0	3,993	1.01	100,813	4,033	4,033	4,033	4,033	4,033	4,033	4,033	4,033	4,033		
Shell	Duct Sealing	20.0	25,332	1.01	511,716	25,586	25,586	25,586	25,586	25,586	25,586	25,586	25,586	25,586		
Shell	Basement / Sidewall Insulation**	25.0	744	1.01	18,778	751	751	751	751	751	751	751	751	751		
Shell	Wall Insulation**	25.0	613	1.01	15,476	619	619	619	619	619	619	619	619	619		
CY2018 Program Total Gas CPAS (Therms)			46,889		892,331	47,358	47,358	47,358	47,358	47,358	47,358	47,358	47,358	47,358		
CY2018 Program Total Gas CPAS (kWh Equivalent)‡			1,374,331		26,154,236	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074		
CY2018 Program Expiring Gas Savings (Therms)§							-	-	-	-	-	-	-	-		
CY2018 Program Expiring Gas Savings (kWh Equivalent)‡§							-	-	-	-	-	-	-	-		

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Shell	Air Sealing**	16,370	16,370	16,370	16,370	16,370	16,370						
Shell	Attic Insulation**	4,033	4,033	4,033	4,033	4,033	4,033	4,033	4,033	4,033	4,033	4,033	4,033
Shell	Duct Sealing	25,586	25,586	25,586	25,586	25,586	25,586	25,586	25,586	25,586	25,586	25,586	
Shell	Basement / Sidewall Insulation**	751	751	751	751	751	751	751	751	751	751	751	751
Shell	Wall Insulation**	619	619	619	619	619	619	619	619	619	619	619	619
CY2018 Program Total Gas CPAS (Therms)		47,358	47,358	47,358	47,358	47,358	47,358	30,988	30,988	30,988	30,988	30,988	5,403
CY2018 Program Total Gas CPAS (kWh Equivalent)‡		1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	908,272	908,272	908,272	908,272	908,272	158,352
CY2018 Program Expiring Gas Savings (Therms)§		-	-	-	-	-	-	16,370	16,370	16,370	16,370	16,370	41,956
CY2018 Program Expiring Gas Savings (kWh Equivalent)‡§		-	-	-	-	-	-	479,802	479,802	479,802	479,802	479,802	1,229,722

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Shell	Air Sealing**												
Shell	Attic Insulation**	4,033	4,033	4,033	4,033								
Shell	Duct Sealing												
Shell	Basement / Sidewall Insulation**	751	751	751	751								
Shell	Wall Insulation**	619	619	619	619								
CY2018 Program Total Gas CPAS (Therms)		5,403	5,403	5,403	5,403	-	-	-	-	-	-	-	-
CY2018 Program Total Gas CPAS (kWh Equivalent)‡		158,352	158,352	158,352	158,352	-	-	-	-	-	-	-	-
CY2018 Program Expiring Gas Savings (Therms)§		41,956	41,956	41,956	41,956	47,358	47,358	47,358	47,358	47,358	47,358	47,358	47,358
CY2018 Program Expiring Gas Savings (kWh Equivalent)‡§		1,229,722	1,229,722	1,229,722	1,229,722	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074

Note: The green highlighted cell shows program total first year gas savings in kWh equivalents.

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

**These measures may include gas savings that are potentially claimed by Nicor Gas, Peoples Gas or North Shore Gas, in their respective territories.

† Lifetime savings are the sum of CPAS savings through the EUL.

‡ kWh equivalent savings are calculated by multiplying therm savings by 29.31.

§ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.

Source: Navigant analysis

Table 3-3. Cumulative Persisting Annual Savings (CPAS) – Total

End Use Type	Research Category	EUL	CY2018 Verified Gross Savings	NTG*	Lifetime Net Savings†	Verified Net kWh Savings (Including Those Converted from Gas Savings)									
						2018	2019	2020	2021	2022	2023	2024	2025	2026	
Shell	Air Sealing**	15.0	886,715.8	1.0	13,433,745	895,583	895,583	895,583	895,583	895,583	895,583	895,583	895,583	895,583	
Shell	Attic Insulation**	25.0	198,947.5	1.0	5,023,424	200,937	200,937	200,937	200,937	200,937	200,937	200,937	200,937	200,937	
Shell	Duct Sealing	20.0	1,009,805.3	1.0	20,398,068	1,019,903	1,019,903	1,019,903	1,019,903	1,019,903	1,019,903	1,019,903	1,019,903	1,019,903	
Shell	Basement / Sidewall Insulation**	25.0	37,805.9	1.0	954,599	38,184	38,184	38,184	38,184	38,184	38,184	38,184	38,184	38,184	
Shell	Wall Insulation**	25.0	29,905	1.0	755,092	30,204	30,204	30,204	30,204	30,204	30,204	30,204	30,204	30,204	
CY2018 Program Total CPAS			2,163,179		40,564,928	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	
CY2018 Program Expiring Savings‡															

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Shell	Air Sealing**	895,583	895,583	895,583	895,583	895,583	895,583	-	-	-	-	-	-
Shell	Attic Insulation**	200,937	200,937	200,937	200,937	200,937	200,937	200,937	200,937	200,937	200,937	200,937	200,937
Shell	Duct Sealing	1,019,903	1,019,903	1,019,903	1,019,903	1,019,903	1,019,903	1,019,903	1,019,903	1,019,903	1,019,903	1,019,903	-
Shell	Basement / Sidewall Insulation**	38,184	38,184	38,184	38,184	38,184	38,184	38,184	38,184	38,184	38,184	38,184	38,184
Shell	Wall Insulation**	30,204	30,204	30,204	30,204	30,204	30,204	30,204	30,204	30,204	30,204	30,204	30,204
CY2018 Program Total CPAS		2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	1,289,228	1,289,228	1,289,228	1,289,228	1,289,228	269,325
CY2018 Program Expiring Savings‡		-	-	-	-	-	-	895,583	895,583	895,583	895,583	895,583	1,915,486

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Shell	Air Sealing**	-	-	-	-	-	-	-	-	-	-	-	-
Shell	Attic Insulation**	200,937	200,937	200,937	200,937	-	-	-	-	-	-	-	-
Shell	Duct Sealing	-	-	-	-	-	-	-	-	-	-	-	-
Shell	Basement / Sidewall Insulation**	38,184	38,184	38,184	38,184	-	-	-	-	-	-	-	-
Shell	Wall Insulation**	30,204	30,204	30,204	30,204	-	-	-	-	-	-	-	-
CY2018 Program Total CPAS		269,325	269,325	269,325	269,325	-	-	-	-	-	-	-	-
CY2018 Program Expiring Savings‡		1,915,486	1,915,486	1,915,486	1,915,486	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811

Note: The green highlighted cell shows program total first year electric savings (including direct electric savings and those converted from gas).

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

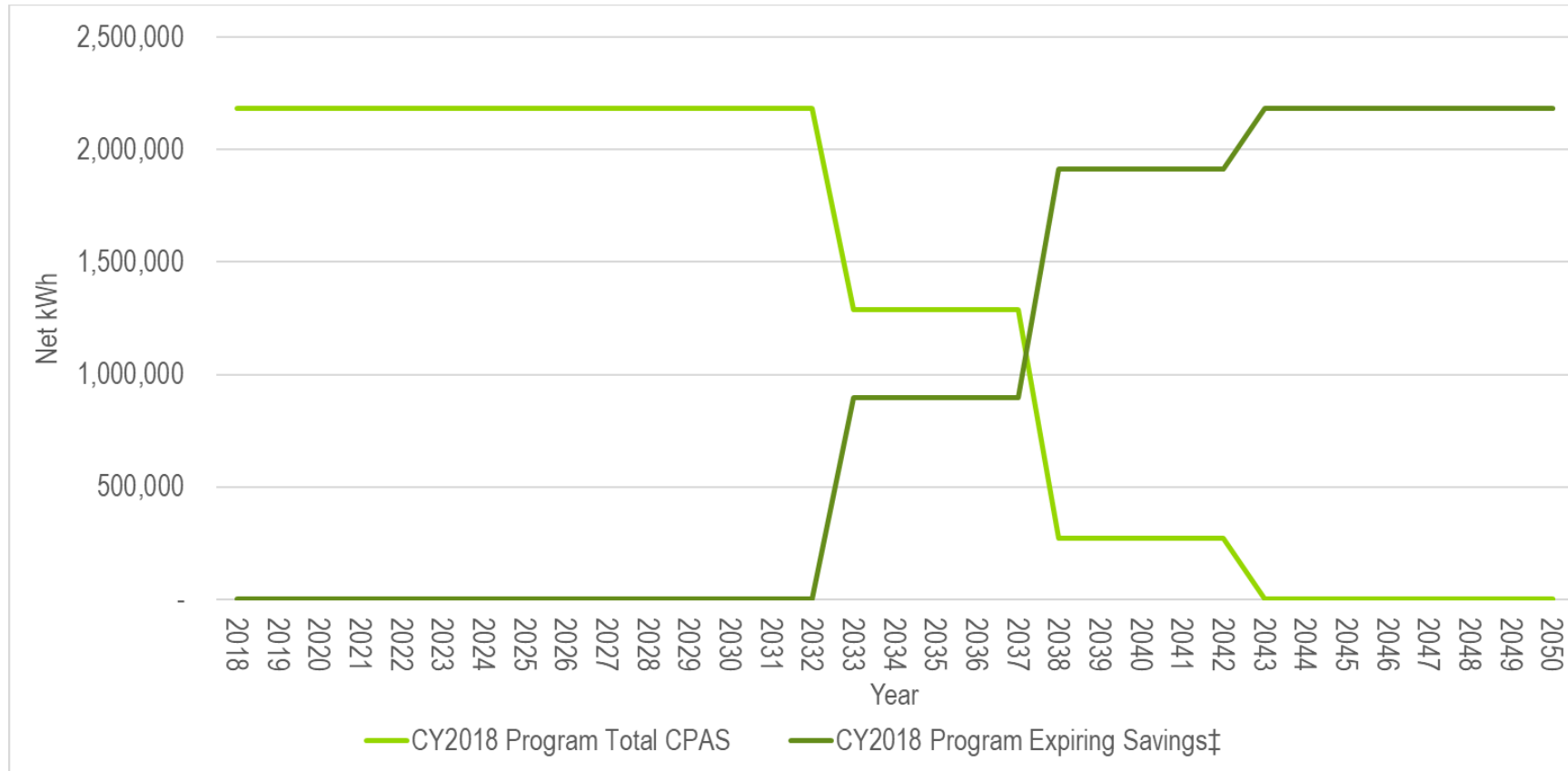
**These measures may include gas savings that are potentially claimed by Nicor Gas, Peoples Gas or North Shore Gas, in their respective territories.

†Lifetime savings are the sum of CPAS savings through the EUL.

‡ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.

Source: Navigant analysis

Figure 3-1. Cumulative Persisting Annual Savings



‡ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.
 Source: Navigant analysis

4. PROGRAM SAVINGS DETAIL

Table 4-1 summarizes the incremental energy and demand savings the Wx Program achieved in CY2018. The gas savings are only those that the gas utilities are not claiming and ComEd can claim.²

Table 4-1. CY2018 Total Annual Incremental Electric Savings

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Summer Peak Demand Savings (kW)
Electricity			
Ex Ante Gross Savings	649,511	NR	492.57
Program Gross Realization Rate	1.21	NA	0.48
Verified Gross Savings	788,848	512.57	238.86
Program Net-to-Gross Ratio (NTG)	1.01	1.01	1.01
Verified Net Savings	796,737	517.69	241.25
Converted from Gas*			
Ex Ante Gross Savings	1,026,271	NA	NA
Program Gross Realization Rate	1.34	NA	NA
Verified Gross Savings	1,374,331	NA	NA
Program Net-to-Gross Ratio (NTG)	1.01	NA	NA
Verified Net Savings	1,388,074	NA	NA
Total Electric Plus Gas			
Ex Ante Gross Savings	1,675,782	NR	492.57
Program Gross Realization Rate	1.29	NA	0.48
Verified Gross Savings	2,163,179	512.57	238.86
Program Net-to-Gross Ratio (NTG)	1.01	1.01	1.01
Verified Net Savings	2,184,811	517.69	241.25

* Gas savings converted to kWh by multiplying therms * 29.31 (which is based on 100,000 Btu/therm and 3,412 Btu/kWh).

Note: Demand savings are defined as the difference in kW in the baseline and energy efficient energy usage in year 2018.

Note: The coincident Summer Peak period is defined as 1:00-5:00 PM Central Prevailing Time on non-holiday weekdays, June through August.

NR = Not Reported

NA = Not Applicable

Source: ComEd tracking data and Navigant team analysis.

5. PROGRAM SAVINGS BY MEASURE

The program includes five measures as shown in the following tables. The air sealing and duct sealing measures contributed to the majority of program savings.

² The evaluation will determine which gas savings will be counted toward goal while producing the portfolio-wide Summary Report.

Table 5-1. CY2018 Energy Savings by Measure – Electric

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)	Effective Useful Life
Shell	Air Sealing	336,526	1.22	411,664	1.01	415,781	15.0
Shell	Attic Insulation	85,432	0.96	81,925	1.01	82,744	25.0
Shell	Duct Sealing	198,184	1.35	267,311	1.01	269,984	20.0
Shell	Basement / Sidewall Insulat	15,193	1.05	16,009	1.01	16,169	25.0
Shell	Wall Insulation	14,176	0.84	11,940	1.01	12,059	25.0
Total		649,511	1.21	788,848	1.01	796,737	

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

Source: ComEd tracking data and Navigant team analysis.

Table 5-2. CY2018 Demand Savings by Measure

End Use Type	Research Category	Ex Ante Gross Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Demand Reduction (kW)	NTG*	Verified Net Demand Reduction (kW)
Shell	Air Sealing	NR	NA	413.48	1.01	417.62
Shell	Attic Insulation	NR	NA	72.48	1.01	73.21
Shell	Duct Sealing	NR	NA	0.00	1.01	0.00
Shell	Basement / Sidewall Insulat	NR	NA	15.63	1.01	15.78
Shell	Wall Insulation	NR	NA	10.98	1.01	11.09
Total		NR	NA	512.57	1.01	517.69

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

NR = Not Reported

NA = Not Applicable

Source: ComEd tracking data and Navigant team analysis.

Table 5-3. CY2018 Summer Peak Demand Savings by Measure

End Use Type	Research Category	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Peak Demand Reduction (kW)	NTG*	Verified Net Peak Demand Reduction (kW)
Shell	Air Sealing	402.29	0.48	192.68	1.01	194.61
Shell	Attic Insulation	49.49	0.68	33.78	1.01	34.11
Shell	Duct Sealing	21.91	0.00	0.00	1.01	0.00
Shell	Basement / Sidewal	9.45	0.77	7.28	1.01	7.36
Shell	Wall Insulation	9.44	0.54	5.12	1.01	5.17
Total		492.57	0.48	238.86	1.01	241.25

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

Source: ComEd tracking data and Navigant team analysis.

Table 5-4. CY2018 Energy Savings by Measure – Gas

End Use Type	Research Category	Ex Ante Gross Savings	Verified Gross Realization Rate	Verified Gross Savings	NTG*	Verified Net Savings	Effective Useful Life
Shell	Air Sealing	14,438	1.12	16,208	1.01	16,370	15.0
Shell	Attic Insulation	3,500	1.14	3,993	1.01	4,033	25.0
Shell	Duct Sealing	15,884	1.59	25,332	1.01	25,586	20.0
Shell	Basement / Sidewall Insulation	641	1.16	744	1.01	751	25.0
Shell	Wall Insulation	551	1.11	613	1.01	619	25.0
Total Therms		35,014	1.34	46,889	1.01	47,358	
Total kWh Converted From Therms†		1,026,271	1.34	1,374,331	1.01	1,388,074	

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

† Gas savings converted to kWh by multiplying therms * 29.31 (which is based on 100,000 Btu/therm and 3,412 Btu/kWh).

Source: ComEd tracking data and Navigant team analysis.

Table 5-5. CY2018 Energy Savings by Measure – Total Combining Electricity and Gas

	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)
Shell	Air Sealing	759,712	1.17	886,716	1.01	895,583
Shell	Attic Insulation	188,026	1.06	198,948	1.01	200,937
Shell	Duct Sealing	663,736	1.52	1,009,805	1.01	1,019,903
Shell	Basement / Sidewall	33,984	1.11	37,806	1.01	38,184
Shell	Wall Insulation	30,325	0.99	29,905	1.01	30,204
Total†		1,675,782	1.29	2,163,179	1.01	2,184,811

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

† The total includes the electric equivalent of the total therms.

Source: ComEd tracking data and Navigant team analysis.

6. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

6.1 Impact Parameter Estimates

Navigant estimated verified unit savings for each program measure using impact algorithms found in the version 6 of the Illinois Technical Reference Manual (TRM)³. Table 6-1 presents the key parameters and the references used in the verified gross and net savings calculations.

³ State of Illinois Technical Reference Manual version 6.0 from <http://www.ilsag.info/technical-reference-manual.html>.

Table 6-1. Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed * or Evaluated?	Source
Quantity	Varies	# measures	Evaluated	
NTG	1.01	%	Deemed	IL SAG Consensus†
Measure Type and Eligibility	Varies		Deemed	
Gross Savings per Unit	Varies	kWh	Deemed	IL TRM v6.0
Verified Realization Rate on Ex Ante Gross Savings (Non-Lighting)	Varies	%	Evaluated	
Effective Useful Life (EUL)	Varies	Years	Deemed	IL TRM v6.0

* State of Illinois Technical Reference Manual version 6.0 from <http://www.ilsag.info/technical-reference-manual.html>.

† A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

6.2 Other Impact Findings and Recommendations

The evaluation team has developed several recommendations based on findings from the CY2018 evaluation, as follows:

Finding 1. For air sealing measures, the implementer used a value of 0.164 kWh/Δ CFM and 0.000196 kW/Δ CFM for all measures. This value is calculated in the MMDB and assumed that the variables used in the calculation are constant across all projects. The following table shows each variable used in the calculation with the TRM variable definition, the value used in the MMDB, and the value, or source, Navigant used in the verified calculations.

Table 6-2. Air Sealing Savings Parameters

Variable	TRM	Implementer Calculation	Navigant Calculation
Delta CFM	Actual	Actual	Used "MeasureQty"
N_cool	Dependent on location and number of stories	34.4	Varies, based on "CoolingDegreeDays"
CDD	Dependent on location	842	Varies, based on "CoolingDegreeDays"
DUA	0.75	0.75	0.75
η Cool	Actual (where it is possible to measure or reasonably estimate). If unknown base on equipment age	12	Used "ExistingCoolingSystemSEER"
LM	Dependent on location	3.2	Varies, based on "CoolingDegreeDays"
N_heat	Based on climate zone, building height and exposure level	21.1	21.1, based on "HeatingDegreeDays"
HDD	Dependent on location	5113	5113, based on "HeatingDegreeDays"
η Heat	Actual. If not available use 72%	0.72	72%, based on "HeatingDegreeDays", or based on electric heating system type and equipment age
FLH_cooling	Dependent on location and household type	570	Varies, based on "CoolingDegreeDays" and "Residential Building Type"
CF	0.68	0.68	0.68

Recommendation 1. Navigant recommends the implementer use the custom inputs provided in the tracking data until deemed values are agreed upon and included in the IL TRM.

Finding 2. For air sealing measures with electric heating, the implementer is using an incorrect equation to calculate kWh heating savings. For the Btu to kWh conversion, the implementer is using 34,112 instead of 3,412. This is causing them to underestimate savings for homes that have electric heating.

Recommendation 2. Navigant recommends the implementer update their MMDB with the correct value of 3,412.

Finding 3. For duct sealing measures, the implementer uses a value of 0.653 kWh / Δ CFM for all measures. This value is calculated in the MMDB and assumes that the variables used in the calculation are constant across all projects. The implementer also assumes that all spaces are semi-conditioned. There are some line items that are unconditioned, causing the heating thermal regain factor, TRFheat, to increase from 0.4 to 1.0. The following table shows each variable used in the calculation with the TRM variable definition, the value used in the MMDB, and the value, or source, Navigant used in the verified calculations

Table 6-3. Duct Sealing Savings Parameters

Variable	TRM	Implementer Calculation	Navigant Calculation
ΔCFM25DL	Actual	Measure_Qty	Used Measure_Qty
CapacityCool	Actual	33,600	Used "Existing_Cooling_System_Estimated_Capacity"
FLHcool	Dependent on location and household type	570	Based on "CoolingDegreeDays" and "Residential Building Type"
TRFcool	1.0 for Unconditioned Spaces; 0.4 for Semi-Conditioned Spaces	0	Based on "Existing_Cooling_System_Type"
ηCool	Actual (where it is possible to measure or reasonably estimate). If unknown base on equipment age	12.5	Used "ExistingCoolingSystemSEER"
OutputCapacityHeat	Actual	76,000	Used "Existing_Heating_System_Estimated_Capacity"
FLHheat	Dependent on location	1,840	Based on "HeatingDegreeDays"
TRFheat	0.40 for Semi-Conditioned Spaces; 1.0 for Unconditioned Spaces	1	Based on "Existing_Cooling_System_Type"
COP	Actual. If unknown, base on equipment age and type	1.61	Used "Existing_Heating_System_Type" and "Existing_Heating_System_Estimated_Age"
InputCapacityHeat	Actual	76,000	Used "Existing_Heating_System_Estimated_Capacity"
ηEquipment	Actual. If not available use 83%	83%	83%
ηSystem	Actual. If not available use 70%	70%	70%

Recommendation 3. Navigant recommends the implementer use the actual inputs provided in the tracking data and account for unconditioned spaces in their default savings values.

Finding 4. For all insulation measures (attic, foundation and wall), the implementer is using deemed value based on the R values to calculate savings. The "Submitted_Gross_Therms_Per_Measure" value in the tracking data does not match the values Franklin provided to Navigant in the "Wx Calculations Update" document. Therefore, Navigant is unable to replicate the implementer's calculations and determine the reason for the difference in therms savings

Recommendation 4. Navigant recommends the implementer update the therms savings value in the tracking data to match the value used in the updated calculations provided to Navigant.

Finding 5. For all insulation measures (attic, foundation, and wall), the implementer is incorrectly assuming that all measures have a value of 842 for Cooling Degree Days. Some homes are in a cooling Climate Zone of 1 and should use 820 for Cooling Degree Days.

Recommendation 5. Navigant recommends the implementer account for multiple cooling zones in the savings calculator.

Finding 6. For insulation measures, the implementer created deemed average savings values based on partial 2018 data. The final tracking data differs slightly than the values used in the

calculator causing a difference in verified savings for foundation and wall insulation measures. The variable driving this change is the Post_R value.

Recommendation 6. Navigant recommends the implementer use actual values instead of deemed ones to calculate savings. In most cases, the implementer used deemed values that correctly represent the final tracking data but using the actual values will ensure more accurate energy savings values.

Finding 7. The TRM v.6 lists multiple coincidence factors for air sealing, duct sealing, and all insulation measures. Where multiple coincidence factors are listed, CF_{PJM} should be used instead of CF_{SSP}

Recommendation 7. Update the coincidence factor to the CF_{PJM} , 0.466, listed in the IL TRM.

7. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

Navigant determined verified gross savings for each program measure by:

1. Reviewing the savings algorithm inputs in the measure workbook for agreement with the IL TRM v6.0
2. Validating that the savings algorithm was applied correctly
3. Cross-checking per-unit savings values in the tracking data with the verified values in the measure workbook or in Navigant's calculations if the workbook did not agree with the TRM
4. Multiplying the verified per-unit savings value by the quantity reported in the tracking data

Navigant calculated verified net energy and demand (coincident peak and overall) savings by multiplying the verified gross savings estimates by a net-to-gross ratio (NTG) of 1.01. In CY2018, the NTG estimates used to calculate the net verified savings were based on past evaluation research and defined by a consensus process through Stakeholder Advisory Group (SAG).

8. APPENDIX 2. IMPACT ANALYSIS DETAIL

Navigant relied on the following documents to verify the per-unit savings for each program measure:

- Final PY2018 tracking database files:
 - "Wx_2018_EOY_Data_Rev0_01282019.xlsx"
 - "WxRebate_supplemental data update.xlsx"
- Illinois Technical Reference Manual (TRM v6.0) for deemed input parameters or secondary evaluation research to verify any custom inputs used in the ex ante calculations.
- Measure calculator's provided by Franklin Energy
 - "Wx Calculations Update.xlsx"
 - "RESIDENTIAL PG NSG MMDV PY10 and PY7.xlsx"

The main reasons the realization rate is not 1.00 across all measures is due to the fact the implementer is using average deemed values to calculate savings. As the TRM stipulates, actual values should be used when provided. The tracking data provides enough information to calculate savings using the actual values. Navigant worked with the implementer to come up with deemed values that are accurate estimates for insulation measures. The final tracking data is slightly different than the data used in the implementers estimates.

9. APPENDIX 3. TOTAL RESOURCE COST DETAIL

Table 9-1, below, shows the Total Resource Cost (TRC) table. It includes only the cost-effectiveness analysis inputs available at the time of finalizing this impact evaluation report. Additional required cost

data (e.g., measure costs, program level incentive and non-incentive costs) are not included in this table and will be provided to evaluation later.

Table 9-1. Total Resource Cost Savings Summary

End Use Type	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (kWh)	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Savings (kWh)	Verified Gross Peak Demand Reduction (kW)	Verified Net Savings (kWh)	Verified Net Peak Demand Reduction (kW)
Shell	Air Sealing	Homes	1,790	15.0	336,526	402.29	411,664	192.68	415,781	194.61
Shell	Attic Insulation	Homes	781	25.0	85,432	49.49	81,925	33.78	82,744	34.11
Shell	Duct Sealing	Homes	945	20.0	198,184	21.91	267,311	0.00	269,984	0.00
Shell	Basement / Sidewall Insulation	Homes	42	25.0	15,193	9.45	16,009	7.28	16,169	7.36
Shell	Wall Insulation	Homes	85	25.0	14,176	9.44	11,940	5.12	12,059	5.17

Source: ComEd tracking data and Navigant team analysis.